

Yuriy Vasilovyth BUTS (Юрий Васильевич БУЦ)*

**METHODOLOGY FOR STUDYING OF INFLUENCE OF FIRE FACTOR
ON GEOSYSTEMS**

ABSTRACT

Materials about the impact of emergency situations of the technogenic and natural character, caused by fires, on geosystems are presented. Methodological features of researches on fire factor influence on geosystem components are shown.

Key words: security, danger, securitology, emergency situations, fire factor, geosystem

**МЕТОДОЛОГИЯ ИССЛЕДОВАНИЙ ВЛИЯНИЯ ПИРОГЕННОГО ФАКТОРА
НА ГЕОСИСТЕМЫ**

РЕЗЮМЕ

Представлены материалы о влиянии чрезвычайных ситуаций техногенного и природного характера, вызванные пожарами на геосистемы. Показаны методологические особенности исследований воздействия пирогенного фактора на компоненты геосистем.

Ключевые слова: безопасность, угрозы, секьюритология, чрезвычайная ситуация, пирогенный фактор, геосист

Fires significantly affect geosystem as a whole, as well as the components of the geosystem: vegetation, soil, wildlife, hydrochemical, geochemical and thermal balances. It takes dozens or even hundreds of years to recover vegetation, and sometimes it is impossible to determine time period necessary for rehabilitation of geosystem to the initial state.

Unusual heat period during the summer (2011) has caused the catastrophic fires in Russia and Spain. Fires in natural geosystems were really terrible also on other continents/states, e.g. Australia, South America, USA. The consequences of such ES cause great losses in the environmental and economic and social terms. Ukraine is not an exception. Statistical data indicate that over the past 5 years, the area covered by the fire in natural ecosystems was from 3800 hectares (in 2006) to 13800 hectares (in 2007). The average area of fire in natural ecosystems varies from 0.5 to 2.5 ha per one case. Physical damages are up to 188 mln UAH per year (1 USD = 7.8 UAH). Most large-scale fires in natural ecosystems happens in the South-Eastern and Southern part

* Assoc. Prof. Yuriy Vasilovyth BUTS, Ph.D. (канд. геогр. наук, доцент Юрий Васильевич БУЦ) – Department of Ecology and Neo-ecology, School of Ecology, V.N. Karazin Kharkiv National University, Kharkiv (Ukraine).
The regular member *EUROPEAN ASSOCIATION for SECURITY*. E-mail: butsyura@ukr.ne buyuv@mail.ru

of Ukraine, in particular, on the Crimean peninsula (*Report Про стан...*). We should also separately mention about fires in ecosystems, located in natural reserves; there are unique landscape complexes, phytocoenoses, natural objects, which can be completely destroyed by fire. In recent years, such fires were registered in the Biosphere Reserve "Askania-Nova", the Ukrainian steppe reserve "Khomutivska steppe", Yalta mountain-forest nature reserve.

All, described above, proves that activity on ES prevention in nature geosystems is really not sufficient. The role of scientists is important for solution of this problem; they can forecast the disaster, and moreover research activity on rapid restoration of "suffered" geosystems should be more active. Certainly, such studies should be conducted on the fundamentals of geography, based on use of system approach. The purpose of this paper is to consider the methodological issues on studying of the pyrogenic factor impact on geosystems. Therefore, the following tasks were formulated: firstly, to summarize the existing scientific activity on the pyrogenic factor impact on geosystems, and secondly, to show the methodological features of the pilot studies in geosciences.

Currently in Ukraine scientific researches for study of the pyrogenic factor effects in geosystems are insufficiently addressed. It can be assumed that existing Ukrainian scientific methods for experimental studies on field-base (*Грин, 1998*) can provide an opportunity to conduct research on the pyrogenic factor impact on geosystems. However, it can not be implemented in full scale.

These are mostly single experimental studies of the effect from fire on specific geosystem's components: vegetation, soil, meso- and microfauna. The publication (*Некос, 2008*) is really very interesting as it summarizes information and data on such impacts. Unfortunately, generalized patterns of pyrogenic factor impacts depending on the geographical zoning of the landscape or structure were not published in Ukrainian scientific journals. There is a lack of researches aimed at rehabilitation and restoration of geosystems. Issues on forest pyrology are addressed better (*Свириденко, 1992*).

Most scientific papers describes issues that are of practical importance and are devoted to: the identification of landscape fire sources, prediction of the fire spreading dynamics (*Покровський, 2002*), depending of forest fire upon the types of trees and plants (*Кузик, 2006*), mathematical modeling of fire spreading in the geosciences (*Калиновський, 2007*), forest firefighting and a number of other tasks not directly related to the nature of the pyrogenic factor impact on the geosystems.

Complex researches on the system level, from geographical positions, are not conducted in Ukraine. It is related to a set of reasons from the methodological point of view.

It is important that the objects of research should be representative. Natural geosystems in protected reserves and areas are best appropriate for conducting of long-term investigations. However, it is prohibited to conduct experimental burns in such areas. The development of the pyrogenic factor in natural conditions is not predictable, as well as the place of fire initiation is not predictable. On the other hand, while conducting controlled burns an area of several dozens of square meters, the question arises: will they objectively impartially determine the pyrogenic factor impact in the full scale?

Investigation on pyrogenic factor impact on geosystems consists of several components: (i) study of the pyrogenic factor probability, (ii) study of the fire impact on the separate geosystem's components, (iii) dynamics of the factor development, (iv) study of the geosystem sustainability to the pyrogenic impact, (v) geosystem rehabilitation after emergencies, caused by pyrogenic factor, etc. The algorithm for further experimental studies will significantly depend on specific goals.

An important feature, in our opinion, is the subject of investigation - a manifestation/ development of the pyrogenic factor, or a fire in the geosystem. Fire in geosystem has several features: (i) the type of fire, (ii) flame velocity, (iii) the power of the fire, (iv) the intensity of the fire edge, etc. The nature of pyrogenic factor impact on geosystem will depend upon the formulation of separate characteristics.

- Another feature of the research is the selection of indicators. From a biological point of view, the fire, primarily affects the vegetation (and soil) as an ecosystem component. From the geographical position, attention should be given to all components, including soil-plant complex, hydrochemical, geochemical, thermal balances, etc. It is important that the research should be conducted on a dynamic basis. The frequency and the reiteration of observations are also very important. Other characteristics such as weather conditions during the research period, specific features of the key sites (e.g., slope exposure), etc. become also significant.

Study of the direct impact of the pyrogenic factor is associated with the development periods, that is, more often in summer. However, Ukraine has tentatively at least three periods of fire risk, in particular:

- spring: the beginning of vegetation associated with the dry grass burning;
- summer: due to the meteorological conditions of the atmosphere, as well as with the human factor; and
- autumn: often associates with the burning of vegetation debris on agricultural areas, also in some way depends on the weather conditions, and the consequences of human negligence.

Nevertheless, the study on geosystem rehabilitation after pyrogenic factor impact can be carried out also during cold seasons. In such cases, the research should be focused on the snow cover, mesofauna, and avifauna, etc.

Repeatability of observations or research should be considered while speaking about the periodicity/ frequency. Again, it depends on a set of factors, first of all on the fire parameters in the geosystem. In case of small fire, geosystem can return to its previous state within a few seasons. Heavy crown fire can result the disastrous consequences in the functioning of geosystems, and even its substantial transformation.

Thus, at present in Ukraine there is a lack of general methodological approaches to the study of the combined effect of the pyrogenic factor in the geosystem. Existing single results need to be summarised in order to identify regeneration and recovery patterns after the impact of emergencies, caused by fires on the geosystem, according to the geographical zoning of individual characteristics and geosystems. Methodological issues on study of the influence of the pyrogenic factor on geosystems have unique

characteristics, but should be on a geographical fundamentals, which are based on the using of systems approach.

BIBLIOGRAPHY

1. ГРИЦЕНКО А.В, БУЦ Ю.В. *До питання методології досліджень відновлення геосистем після надзвичайних ситуацій*. - Х.: ВД «Райдер», 2011. - «Проблеми охорони навколишнього природного середовища та екологічної безпеки» : зб. наук. пр. УкрНДІЕП, 2011, Вип. XXXIII. – С. 3-11
2. ГРИН А.М., УТЕХИН В.Д., КИБЗУН А.П. и др. – М.: Наука, 1988. – «*Природные геосистемы центральной лесостепи Русской равнины*». - 144с.
3. КАЛИНОВСЬКИЙ А.Я. *Математичне моделювання контуру вигорання при лісових пожежах*: автореф. дис. на здобуття наук. ступеня канд. техн. наук: спец. 21.06.02. «Пожежна безпека». - Харків, 2007. – 19с.
4. КУЗИК А.Д. *Про залежність пожежної безпеки лісів України від типів лісових насаджень*. – Львів : ЛПБ. – 2006- «Пожежна безпека», 2006, № 9. – С. 34-37.
5. НЕКОС В.Ю., ПІЧУГІНА Ю.О. *Проблема впливу пожеж на стан рослинного покриву*. - Харків : ХНУ, 2008 - «*Людина і довкілля. Проблеми неоекології*», 2008, № 1-2. – С. 21-25
6. ПОКРОВСЬКИЙ Р.Л. *Раннє виявлення осередків ландшафтних пожеж та прогноз динаміки їх розповсюдження* : автореф. дис. на здобуття наук. ступеня канд. техн. наук: спец. 21.06.02. «Пожежна безпека». - Харків, 2002. – 18с.
7. ПРО стан техногенної та природної безпеки в Україні 2004-2009 роках: *Нац. доповіді [електронний ресурс]*. Режим доступу: http://www.mns.gov.ua/content/national_lecture.html.
8. СВИРИДЕНКО В.С., БАБІЧ О.Г., ШВИДЕНЬКО А.Й. *Лісова пірологія*. – К. : Агрпромпвидав України, 1999. – 172 с.

Recenzent - Reviewer - Рецензент:

Artykuł recenzowany przez dwóch niezależnych recenzentów – wykaz na rewersie strony tytułowej.

An article reviewed by two independent critics – see a list on the back of the title page.

Стаття, оцінюється двома незалежними рецензентами - перечень на обороті заглавного листа.